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NAVAL POSTGRADUATE SCHOOL

Monterey, California



THESIS

**COST/BENEFIT ANALYSIS
OF
LEASING VERSUS PURCHASING COMPUTERS**

by
Alan J. Arceneaux

December, 1997

Thesis Co-Advisors:

Cynthia J. Levy
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The purpose of this Thesis was to present a cost/benefit analysis of leasing versus purchasing computers. This analysis was performed to provide a decision making model for the acquisition of computer assets. It is additionally intended to serve as a framework to compare the costs and benefits of leasing over purchasing.

To address this issue, a capital budgeting model was developed and net present value analysis performed. In constructing this model, several factors were considered, including: The purchase cost of computer equipment, annual lease payments, depreciation costs, the opportunity cost of purchasing, tax revenue implications and various leasing terms. Data for this thesis was collected using historical records, literature reviews, and interviews.

This research found that it is more cost effective for the Naval Postgraduate School and other Naval Shore-based commands to purchase equipment rather than lease.

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**COST/BENEFIT ANALYSIS OF
LEASING VERSUS PURCHASING COMPUTERS**

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B.S., Oregon State University, 1990

Submitted in partial fulfillment of the
requirements for the degree of

MASTER OF SCIENCE IN MANAGEMENT

from the

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TABLE OF CONTENTS

I.	INTRODUCTION.....	1
A.	BACKGROUND.....	1
B.	OBJECTIVE.....	1
C.	PROBLEM STATEMENT	2
D.	RESEARCH QUESTIONS.....	2
E.	METHODOLOGY.....	4
F.	ORGANIZATION OF THE THESIS	5
II.	BACKGROUND	7
A.	OVERVIEW.....	7
B.	SHIFT TOWARDS LEASING	7
C.	EVOLUTION OF TECHNOLOGY.....	8
D.	TECHNOLOGY IN THE MILITARY	10
E.	INFORMATION TECHNOLOGY FOR THE 21ST CENTURY (IT-21)	11
F.	INFORMATION TECHNOLOGY AT CIVILIAN UNIVERSITIES	12
G.	NAVAL POSTGRADUATE SCHOOL.....	14
III.	LEASE TYPES AND STRUCTURES.....	17
A.	GENERAL	17
B.	OPERATING LEASES.....	17
C.	LEASING CRITERION.....	20
IV.	CALCULATIONS AND ASSUMPTIONS.....	23
A.	INTEREST RATES	23
B.	TIME VALUE OF MONEY	23
C.	COST OF CAPITAL	24
D.	DISPOSAL COSTS	25
E.	MAINTENANCE/WARRANTY COSTS	25
F.	PRESENT VALUE FACTORS	26
G.	LEASE FIGURES TABLE	27
V.	COST/BENEFIT ANALYSIS	29
A.	COST TO PURCHASE A COMPUTER SYSTEM.....	29
B.	BENEFITS TO PURCHASING A COMPUTER SYSTEM.....	29
C.	COST TO LEASE A COMPUTER SYSTEM	30
D.	BENEFITS OF LEASING A COMPUTER SYSTEM	31
E.	AT&T PURCHASE/LEASE COMPARISON.....	34
F.	GOVERNMENT LEASING COMPANY PURCHASE/LEASE COMPARISON	40
G.	DIGITAL EQUIPMENT CORPORATION PURCHASE/LEASE COMPARISON.....	46
VI.	PRESENTATION OF DATA.....	53
A.	AT&T COMPARISON GRAPHS	53
B.	GOVERNMENT LEASING COMPANY COMPARISON GRAPHS.....	55
C.	DIGITAL EQUIPMENT CORPORATION COMPARISON GRAPHS	57
D.	CONSOLIDATED GRAPH FOR ALL THREE COMPANIES.....	59
E.	CONSOLIDATED GRAPH FOR THREE-YEAR PERIOD	62
VII.	CONCLUSION	65

A.	CONCLUSIONS	65
B.	RECOMMENDATIONS	66
C.	FOLLOW-ON RESEARCH.....	66
LIST OF REFERENCES.....		67
INITIAL DISTRIBUTION LIST		69

I. INTRODUCTION

A. BACKGROUND

Since the early eighties, the technological capability of computer systems has experienced exponential growth. As systems have become more advanced, the range of their possibilities has dramatically increased. This is evident within the Department of Defense (DoD), where computer technology is critical. Throughout the military, hundreds of thousands of computer systems are utilized. However, the rapid change in technology poses special problems for the defense industry. The current acquisition strategies that are in place do not always facilitate acquiring the latest technology in a timely manner.

B. OBJECTIVE

In this thesis, I will examine the strategy of leasing computers as opposed to an outright purchase and then determine if there are cost savings and other benefits of leasing versus purchasing. This analysis is performed to provide a decision making model for the acquisition of

computer assets. It is intended to serve as a framework to compare the costs and benefits of leasing versus purchasing.

C. PROBLEM STATEMENT

As technology is rapidly changing, computer systems are becoming obsolete at a faster rate. However, keeping pace with technological advances is extremely difficult. When an institution acquires and implements a computer system, it often finds that the technology is no longer current in a year or two after the initial purchase. Most organizations would expect to see a useful life of many years. This is especially true when hundreds of thousands of dollars is spent on the equipment. Therefore, the problem that many institutions face is how to maintain the current technology in computing equipment, while keeping costs down.

D. RESEARCH QUESTIONS

The primary research question is the following: **Is it more cost effective to lease computers at the Naval Postgraduate School than to buy them?**

Subsidiary questions to be addressed in assessing the cost and benefits associated with a leasing strategy are:

1. How much does it cost to lease a computer?

The cost of a lease will vary with the terms and structure of the leasing arrangement. The two primary factors in a lease are a) the length of the lease and b) the residual amount due at its termination. For the purposes of this thesis, a lease will be evaluated for a two and three year period and at a residual value of fair market value.

2. What is the lifecycle of a computer system?

To answer this question, I have examined the development and introduction of both hardware and software over the last ten years. This data will be use to extrapolate the life of a computing asset.

3. Is it necessary for NPS to acquire and maintain the latest computer technology?

In order to validate a leasing strategy, it must be necessary for an organization to require the latest computer technology. Therefore, I will explore the requirements for the Naval Postgraduate School to have the most up-to-date technology available.

4. Is a leasing program a viable option for other shore-based commands within the Department of Defense?

Based on the analysis and model created, I will determine if this model can be applied to other shore-based commands.

E. METHODOLOGY

Data for this thesis was collected using historical records, literature reviews, and interviews.

I gathered historical data through an examination of the Defense Resources Management Office's (DRMO) records in Stockton, California. This was done to ascertain the disposal costs of obsolete computer systems. I then examined property record at the Naval Postgraduate to determine the number of computers that were acquired, maintained and retired each year.

Next I conducted literature reviews. This was done to determine the development and lifecycle of both the computer hardware and its operating systems. In particular, I focussed on the introduction of the 386, 486, Pentium, Pentium Pro and Pentium II processors. Additionally, I

evaluated the release of the operating systems that are most commonly used in personal computers, which are developed by the Microsoft Corporation. This was done in an attempt to deduce the useful life of a computer system.

The final area of my research was done through interviews. I contacted several organizations that leased to the United States Government. I posed several questions to these individuals on the terms, structures and costs of these leases. This means of data collection was necessary because most of these organizations do not publish specific lease terms. Additionally, I conducted interviews with faculty and staff at NPS to determine requirements and needs for respective laboratories in this study.

F. ORGANIZATION OF THE THESIS

This thesis will be organized around seven chapters. The first chapter provides a statement of the problem and poses research questions that will be addressed in the thesis. The second chapter will explain the background of leasing and the concepts associated with a lease versus buy cost comparison. The next chapter, three, will evaluate the different types of leases and costs associated with each

one. Specifically, it will present the terms of a two-year and a three-year lease with a fair market value residual. Chapter IV will be an examination of the scope of research and explanation of terms and calculations used in the thesis. Chapter V will analyze the cost and benefits of both a lease and an outright purchase. All categories of cost and benefits will be evaluated. This will include both tangible and intangible aspects. The results of the cost/benefit analysis will be presented in Chapter VI. Lastly, Chapter VII will summarize the findings of this thesis, present views and recommendations, and discuss follow-on research.

II. BACKGROUND

A. OVERVIEW

Leasing is increasing in both popularity and use in the corporate world. Nearly two-thirds of the Fortune 500 companies are now leasing, not purchasing, their computer equipment. With today's rapid turnover in technology, information systems professionals must determine how they will advance to the next platform every few years. (Potter, 1997)

Surveys concluded by firms such as Hewlett-Packard and IBM indicate that the numbers of leasing clients is growing at an incredibly rapid pace. In fact, both of these international computer manufactures have recently announced leasing partnerships with such firms as AT&T in order to ready themselves for the increased client demand for leasing. (Potter, 1997)

B. SHIFT TOWARDS LEASING

Why the apparently sudden increase of interest in a financing method that people have been talking about and using for over twenty-five years? The answer centers on the

fact that computer technology changes faster than the accountant can write off the equipment. Corporations are consistently faced with the problem of capital expenditures on computer equipment rapidly decreasing in value in only a couple of years. This coupled with the competitive environment that most firms operate in, necessitate the need for the latest technology. Furthermore, these organizations are able to write off the monthly lease payments, (or in the case of Capital Leases, depreciation and finance charges), thereby making this, in some cases, a more viable strategy than purchasing. However, this is not an option for the Federal Government.

C. EVOLUTION OF TECHNOLOGY

Over the past decade, computer technology has evolved significantly in terms of both hardware and software. From the days of Windows 3.0 and 486 DX, 25 MHz processors, we now look to Windows NT and Pentium IIs at speeds of 300 MHz. The change in processing speeds alone has increased by 1,100 percent during the last ten years. The following text covers this evolution in technology from 1989 up to date.

In 1989, the 486 DX, 25 MHz chip was introduced, replacing the 386 chip. Two years later, 1991, the 486 DX, 50 MHz chip was developed. Then in 1993, the Pentium chip was invented with a clock speed of 60 MHz, which was a new generation of computing capabilities. The first Pentium chip was replaced at the beginning of 1995 by a 100 MHz processor. Subsequently, by the end of the year, the 200 MHz processor was developed. The year of 1996 did not bring any new processors to market. The following year, though, saw the development and introduction of the 233 MHz and 300 MHz processors.

Operating systems have also undergone major changes in the last decade. Microsoft Windows 3.0 was introduced in 1989 and was intended to replace DOS commands and make the operating environment more user friendly. In 1992 Windows 3.1 was designed and implemented to replace 3.0. Three years later, a revolutionary, new operating system was developed. This was known as Windows 95 and soon set the standard in operating systems. For almost two and half years this system has been in use and is found on over eighty percent of the desk-top computers world wide. The

follow-on to Windows 95 is Windows 98, which has not yet been released, but is due out in January of 1998. (Hirsch, 1997, pp. 122-126)

The previously discussed text leads to several revelations. First, hardware has changed on average every two years since 1989. Secondly, the operating systems have changed every three years. This leads to the conclusion that in order to stay current with the latest technology, an organization should either buy new computing devices or upgrade the ones they currently own every two to three years.

D. TECHNOLOGY IN THE MILITARY

As is the case in many of the private organizations, the military has a need for up-to-date technology as well. This was readily apparent during the Gulf War in which many new technological devices were tested. Daily, the American public witnessed news images of smart bombs, global positioning systems (GPS), computer tracking devices and a multitude of other gadgets. This high degree of technology was an indisputable contributory factor to the tremendous success of the war. Furthermore, when one juxtaposes our

technology with that of Iraq, it becomes readily apparent that the most advanced equipment yielded significant benefits.

The dramatic increase in computer systems has swept through the military and our now an integral part of almost every unit within the Department of Defense (DOD). The challenges to stay current in technology are equal to or greater than those experienced by private firms. Military leaders are realizing smaller budgets and other resource constraints, but are experiencing an increase in missions and operational commitments. Therefore, many organizations within DOD, both operational and shore-based commands, are trying to do more with less. In the area of computer assets, this means getting the most from a computing system, while conserving capital.

E. INFORMATION TECHNOLOGY FOR THE 21ST CENTURY (IT-21)

IT-21 is one of the Navy's responses to adapt and develop new operational concepts in an ever changing technological environment. It provides for accelerated implementation of C4I innovations and existing C2 programs that are currently funded in the budget. The leadership

within the navy fully supports IT-21, and it is embraced by all Fleet Commanders. The implementation of IT-21 is a challenge to the current programming and budgeting process because of the rapid changes. However, the Navy is committed to making it work and is seeking methods to achieve the program.

Although the IT-21 plan is under study, it looks promising. The concept is to stay common with industry, and use commercial off-the-shelf hardware/software. Additionally, IT-21 is intended to provide a smooth information flow between Shore and Sea commands. The Navy will form partnerships with the civilian sector to develop solutions, use industry standards and commercial off-the-shelf (COTS) products to avoid R&D costs and to outsource and lease those services that make sense. (Information Technology)

F. INFORMATION TECHNOLOGY AT CIVILIAN UNIVERSITIES

As students and professors continue to demand the newest and most capable computing resources, some colleges are discovering that leasing the hardware may be more practical than buying it. In recent months, several

computer companies and financiers have begun to aggressively market leasing programs aimed at colleges and universities. Apple Computer Inc., Compaq computer Corporation, and the credit arm of IBM have announced new, low-interest leasing programs. In addition, large financial institutions are promoting their lease-financing plans as solutions to colleges' changing computer needs. Technology leasing is not yet sweeping academe. Only about ten percent of colleges lease their computer equipment. However, leasing is catching on because of the changing nature of the computer market. Institutions as diverse as the University of California at Berkeley, with its legions of graduate students, and Fox Valley Technical College, which needs state-of-the-art equipment to train workers for industry, have either leased or are considering it.

Many colleges that have elected to lease say concerns about obsolescence influenced their decision. Connecticut College, for example, concluded that leasing 500 new computers for faculty and staff members was cheaper than buying them. Connecticut's four-year lease with Apple calls for the college to pay about \$475,000 a year by the fourth

year, when all of the computers will have been acquired. That is less than it had spent annually to replace and upgrade computers with outright purchases. (Blumenstyk, 1996, pp. A23)

G. NAVAL POSTGRADUATE SCHOOL

The Naval Postgraduate School is a prime candidate for new methods of acquiring technology. Currently, there are over 4,000 personal computers alone in use at the school, which does not include mainframes, printers, servers, etc. (Herb, 1997) Every department has a need for computing devices. There is a massive amount of research that is undertaken at this institution that is heavily dependant on computer systems. These devices are used for research, conducting classes, preparing documents, communications, accessing the internet and running simulations. As was discussed earlier in this paper with other organizations, the Naval Postgraduate School is not immune to technological obsolescence. Being that it is an academic environment, it may have a greater need for the most current technology.

The analysis of this thesis will look at three Computer Systems Laboratories within the Naval Postgraduate School.

Specifically, the laboratories in Ingersol 251, Glasgow 128 and Spanagel 511 will be evaluated. (Functional, 1997) Although there are several other departments with computers, this will provide a representative sample of all of them. The size and complexity of the computer systems in use at the school make it necessary to narrow the focus to these areas. However, the model that will be designed is intended to be used for the entire Naval Postgraduate School as well as other shore-based commands.

III. LEASE TYPES AND STRUCTURES

A. GENERAL

There are two common types of leases: 1) Capital lease and 2) Operating lease. A capital lease is very similar to a purchase and therefore, will not be used during the analysis within this thesis. However, an operating lease could be more beneficial to an organization and will be the focus of the discussion.

B. OPERATING LEASES

An operating lease or "true lease" is the same type that is gaining popularity in the automobile industry. Basically, the parties, lessor and lessee, negotiate the cost, length, and residual value of the asset. Then financing will be designed so that the monthly payments capture the interest and principal on the value of the asset that is used during the lease. (Concepts, 1997) This is obtained by the depreciation of the equipment each year. For example, let us examine a car valued at \$20,000 with a six-year life. It will be leased for four years, and subsequently depreciated on a straight line basis for six

years. The book value would then be the residual amount left over after four years of accumulated depreciation. Then the amount of the lease would be based on the four years of usage or, in other words the accumulated depreciation. Therefore, the \$20,000 car would be divided by six years to yield an annual depreciation of \$3,333. This would then be multiplied by four (for each year of usage) to equal \$13,332, which is the sum of the accumulated depreciation. The total depreciation would be multiplied by a money factor to obtain the monthly payments (A money factor is similar to a stated interest rate and is the cost of capital charge for a lease). In this example, a money factor of .02448 will be used for a four-year lease. Multiplying .02448 by \$13,332 equals \$326, which results in the monthly payment amount or \$3,912 a year.

The above example illustrates that a \$20,000 automobile could be leased for \$326 a month over a four year period with a residual value of \$6,666. At the end of the lease, the lessee can either return the car or pay the \$6,666 to purchase it. In each case, a total of \$15,468 ($\326×48) would have been made in monthly payments. This figure,

\$15,468, added to the residual value, \$6,666, sums to \$22,314, which would be the total amount paid if the car was acquired at the end of the lease.

Now let us assume that the same automobile would be purchased instead of leased. A \$20,000 amount would be financed for four years using the same interest rate as the lease. In this case the monthly payments are \$426 vice the \$326 in the lease. However, at the end of the finance period the car is paid for and no further monies are owed.

The above examples show a basic illustration of a lease. Some areas of note for this illustration, though. First, a lease provides a lower monthly payment than a purchase. Second, purchasing eliminates the residual value and ownership is obtained at the end of the financing period. Thirdly, the interest rate is the same in both the lease and purchase. Lastly, the amount of residual is a function of the pre-determined value of the asset at the end of the term. In this example, the car had one third of its original value after four years. This is not always the case, however.

Computer assets depreciate at a much more expedient rate than automobiles. For example, a computer system may only be worth one percent of its original value after four years. When this scenario arises, the line between leasing and purchasing becomes blurred and it can be indistinguishable at times. This is especially true when there are no tax advantages to leasing, as is the case with the Federal Government.

C. LEASING CRITERION

There are several criteria that are used in the structure of a lease. First, a lease will be established over a time period of from one to five years. The longer the lease life the more expensive it will be. This is mainly due to the depreciation of the equipment over time. For the purposes of this analysis, a lease life of two and three years was used. Secondly, leases have residual values that determine the amount the lessee would have to pay at the end of the lease term to own the equipment outright.

There are three residual values that are most commonly used: 1) ten percent of the initial cost, 2) fair market value, and 3) one dollar buy back. Each of these methods

will effect the price that is paid for the lease. However, for the purpose of this thesis, and due to industry practices, only fair market value residuals were used.

IV. CALCULATIONS AND ASSUMPTIONS

A. INTEREST RATES

Analyses of nominal lease payments should use the nominal Treasury borrowing rate on marketable securities of comparable maturity to the period of analysis to determine the cost of capital to be used. Nominal Treasury borrowing rate should be taken from the economic assumptions for the President's budget. (OMB Circular) For the purpose of this analysis, an interest rate of 7.30% was used. This was determined by using the table in Appendix C of the OMB Circular Number A-94. Furthermore, this was based on a two and three year period.

B. TIME VALUE OF MONEY

In order to compute net present value, it is necessary to discount future benefits and costs. This discounting reflects the time value of money. Benefits and costs are worth more if they are experienced sooner. All future benefits and costs should be discounted using the appropriate discount rate as discussed previously. The higher the discount rate, the lower is the present value of

future cash flows. For typical investments, with costs concentrated in early periods and benefits following in later periods, raising the discount rate tends to reduce the net present value. (OMB Circular)

C. COST OF CAPITAL

An opportunity cost was computed for the lost investment potential when an acquisition is purchased vice leased. In this case, a total of \$364,926 was required to purchase the upgrades for the three laboratories under study. However, if the assets were leased each year, the annual payments would be a fraction of this amount. Therefore, the funds in excess of the annual lease payments could be invested by the Federal Government. The rate would be the same as the discount rate of 7.30%, as discussed previously. Although the Federal Government may not actually invest these funds, it would not have to borrow them to meet the annual deficit. The above calculation will be performed in the cost/benefit analysis in the next two chapters.

D. DISPOSAL COSTS

The disposal costs were not used in the cost/benefit analysis. Whether an organization is leasing or purchasing a computer, there will be disposal costs. In the event a lease is contracted, the organization or lessee is responsible to return the computers to the lessor at the end of the leasing period. However, if a computer system is purchased outright by a Federal Agency, the asset must be disposed of through the Defense Resource Management Office (DRMO). For the Naval Postgraduate School, the nearest DRMO is in Stockton, California. Therefore, the handling and shipping costs would be equal for both a purchase or a lease and will not be a factor in this analysis.

E. MAINTENANCE/WARRANTY COSTS

The systems that are under consideration for the Naval Postgraduate School come with a standard one year warranty. Additionally, there are options to purchase a two or three year warranty in lieu of the standard one. In either case, though, these warranties would apply in a leasing situation as well.

F. PRESENT VALUE FACTORS

The present value calculation is a method to determine the value today, or at some specific date, of an amount or amounts to be paid or received later, or at other, different dates. (Stickney, 1994, pp. 39) These amounts are discounted at some interest or discount rate. Once the interest or discount rate and the number of years are determined, they will be applied to the following formula to obtain the present value factors. Then these factors will be multiplied to a future period's cash outflow or inflow to determine its value today.

FORMULA FOR PRESENT VALUE FACTORS

$$P = F_n (1 + r)^{-n}$$

P = Present Value

F_n = Future Value of \$1

r = interest rate

n = number of periods

In this analysis, the interest rate used was 7.30% for a one, two and three year period. Applying these numbers to the above formula yielded present value factors of .9320, .8686 and .8055 for years one through three, respectively.

G. LEASE FIGURES TABLE

COMPANY	RESIDUAL VALUE	TWO-YEAR MONEY FACTOR	THREE-YEAR MONEY FACTOR
AT&T LEASING COMPANY	FAIR MARKET VALUE	.04440	.03340
GOVERNMENT LEASING CORPORATION	FAIR MARKET VALUE	.04730	.03320
DIGITAL EQUIPMENT CORPORATION	FAIR MARKET VALUE	.04284	.03125

The information in the table was obtained directly from each company. Additionally, these factors were determined with a residual of fair market value. Furthermore, the money factors reflect the capital charge for a two-year and a three-year period.

V. COST/BENEFIT ANALYSIS

A. COST TO PURCHASE A COMPUTER SYSTEM

There are several areas that were analyzed to determine the cost of purchasing a computer.

1. Purchase price. There were laboratories that needed new computer equipment. The total cost of these requirements was \$364,926. This figure was the basis for the analysis in each purchase scenario. (Functional, 1997)

2. Cost of capital. To determine the cost of capital, it was first necessary to determine the life of the computer systems. For the purpose of this evaluation the life was one to three years. (Hirsch, 1997, pp. 122-126) Secondly, it was necessary to apply a discount rate. OMB Circular A-94 states that the cost of capital for all leasing analyses will be the nominal Treasury-bill borrowing rate, which is currently 7.30%.

B. BENEFITS TO PURCHASING A COMPUTER SYSTEM

1. OWNERSHIP. When A DOD activity owns equipment outright, there are less restrictions placed on it. For example, a company is free to take parts/components from one

machine to place on another, use the equipment in remote areas under adverse conditions, or do other things with the assets, that may have otherwise been prohibited by the leasing clause.

2. PUSH-DOWN EFFECT. An organization may take older technology and put it to use in other areas of the command, which may not need the cutting edge equipment. Therefore, the equipment life may be extended and provide benefits to the organization.

3. COMMUNITY GOODWILL. Once a computer asset has reached its useful life, DOD can turn it into DRMO, or it may donate it to local public schools. Giving the equipment to local schools will can enhance community relations and increase goodwill.

C. COST TO LEASE A COMPUTER SYSTEM

There are several areas that were examined to determine the costs associated with leasing a computer.

1. LEASE PAYMENTS. Whenever an organization enters into a leasing arrangement, it will have to make annual lease payments. The amount will be determined by a money factor multiplied by the cost of equipment. As stated

earlier, the money factors vary by each company and the length of the lease.

2. DEPRECIATION CHARGE. The depreciation charge is the forgone tax revenue that the Federal government does not collect. This results from the leasing company's ability to depreciate the equipment, which shields a portion of its income. Because this amount would have otherwise been collected by the Federal Government if an outright purchase was made, it must be treated as a cost when doing leasing versus buy comparison. (OMB Circular)

3. NON-OWNERSHIP. There are many restrictions placed on leased equipment. In the event the restrictions are violated, it can lead to penalties and additional charges.

D. BENEFITS OF LEASING A COMPUTER SYSTEM

1. AVOID TECHNICAL OBSOLESCENCE. Organizations that purchase computer assets outright incur a sunk cost from the onset. If there is a change in technology subsequent to that purchase, the organization is stuck with the original purchase. However, with a lease, the outdated equipment can be returned and new technology can be obtained.

2. LACK OF FUNDING AND CONVENIENCE CLAUSE. Whenever the Federal Government enters into a leasing contract it may terminate the contract at anytime for lack of funding or for convenience. For example, if an organization's budget was going to be cut in an upcoming fiscal year, it could terminate the lease. Additionally, if an organization was down-sized and did not need as many computer assets, it could also terminate the lease.

3. CASH FLOW IMPROVEMENT. Monthly payments can be adjusted to suit an operating budget which will in-turn improve the cash flow forecasting. The fixed nature of a lease obligation eliminates any uncertainty about the future cost of the equipment. Therefore, this will facilitate cash forecasting and planning.

4. CONSERVATION OF CAPITAL. Conventional DOD purchases of computers are done up front, which requires payment in full on the date the asset is purchased. This can lead to a large amount of capital tied up at any given time. However, with a lease, the payments are spread out over two to three years. This will not only improve the

conservation of capital, but will also result in time value of money savings.

The following sections (E through G), will show the cost and benefit calculation results. These sections will be organized by leasing company and by number of years of the lease. Therefore, Section E will show a two year purchase versus lease comparison for data from AT&T Leasing company. Then the data will be computed on a three year basis. This will be the format for each of the three leasing companies that was used in this analysis.

E. AT&T PURCHASE/LEASE COMPARISON

1. PURCHASE FOR TWO YEARS

<u>CATEGORY</u>	PRESENT		END OF YEAR		
	<u>VALUE</u>	<u>FACTOR</u>	<u>YEAR 0</u>	<u>YEAR 1</u>	<u>YEAR 2</u>
PRICE	(\$364,926)	1.0000	(\$364,926)		
COST OF CAPITAL	(\$ 18,820)	0.9320		(\$20,193)	
	(\$ 5,345)	0.8686			(\$6,154)

PRESENT VALUE
OF NET
OUTFLOW (\$389,091)

2. LEASE FOR TWO YEARS

<u>CATEGORY</u>	PRESENT		END OF YEAR		
	<u>VALUE</u>	<u>FACTOR</u>	<u>YEAR 0</u>	<u>YEAR 1</u>	<u>YEAR 2</u>
ANNUAL LEASE PAYMENTS	(\$179,579)	0.9320		(\$192,681)	
	(\$167,363)	0.8686			(\$192,681)
COST OF CAPITAL	\$ 18,820	0.9320		\$20,193	
	\$ 5,345	0.8686			\$6,154
DEPRECIATION TAX BENEFIT	(\$ 42,514)	0.9320		(\$45,616)	
	(\$ 39,622)	0.8686			(\$45,616)
PRESENT VALUE OF NET OUTFLOW	(\$404,913)				

3. AT&T TWO-YEAR LEASING FIGURES

FIRST YEAR

<u>MONTH</u>	<u>VALUE</u>
JAN	\$364,926
FEB	\$348,869
MAR	\$332,812
APR	\$316,755
MAY	\$300,698
JUN	\$284,641
JUL	\$268,854
AUG	\$252,527
SEP	\$236,470
OCT	\$220,413
NOV	\$204,356
DEC	\$188,299
TOTAL	\$3,319,350
AVERAGE	\$276,613

SECOND YEAR

<u>MONTH</u>	<u>VALUE</u>
JAN	\$172,245
FEB	\$156,188
MAR	\$140,131
APR	\$124,074
MAY	\$108,017
JUN	\$ 91,960
JUL	\$ 75,903
AUG	\$ 59,846
SEP	\$ 43,789
OCT	\$ 27,732
NOV	\$ 11,675
DEC	\$ 0
TOTAL	\$1,011,560
AVERAGE	\$ 84,297

MONTHLY PAYMENTS	\$ 16,057 (MONEY FACTOR X BEG BAL)
ANNUAL PAYMENT	\$192,681 (MONTHLY PAYMENTS X 12)
INTEREST RATE	7.30% (PRESIDENT'S ECONMOMIC REPORT)
BEGINNING BALANCE	\$364,926 (COST OF COMPUTER ACQUISITION)
MONEY FACTOR	0.04440 (PROVIDED BY LEASING COMPANY)
GAIN ON INVESTMENT	
YEAR 1	\$ 20,193 (ANNUAL AVERAGE X INTEREST
YEAR 2	\$ 6,154 RATE FOR EACH YEAR)

4. PURCHASE FOR THREE YEARS

<u>CATEGORY</u>	PRESENT		END OF YEAR			
	<u>VALUE</u>	<u>FACTOR</u>	<u>YEAR 0</u>	<u>YEAR 1</u>	<u>YEAR 2</u>	<u>YEAR 3</u>
PRICE	(\$364,926)	1.0000	(\$364,926)			
COST OF CAPITAL	(\$ 19,539)	0.9320		(\$20,965)		
	(\$ 9,615)	0.8686			(\$11,069)	
	(\$ 1,239)	0.8095				(\$1,531)

PRESENT VALUE
OF NET
OUTFLOW (\$395,319)

INITIAL PURCHASE PRICE \$364,926
COST OF CAPITAL 7.30%

5. LEASE FOR THREE YEARS

PRESENT

	PRESENT	VALUE	END OF YEAR			
<u>CATEGORY</u>	<u>VALUE</u>	<u>FACTOR</u>	<u>YEAR 0</u>	<u>YEAR 1</u>	<u>YEAR 2</u>	<u>YEAR 3</u>
ANNUAL LEASE (\$136,316)	0.9320			(\$146,262)		
PAYMENTS						
	(\$127,043)	0.8686			(\$146,262)	
	(\$118,399)	0.8095				(\$146,262)
COST OF	\$ 19,539	0.9320		\$20,965		
CAPITAL						
	\$ 9,615	0.8686			\$11,069	
	\$ 1,239	0.8095				\$1,531
DEPRECIATION (\$ 28,343)	0.9320			(\$30,411)		
TAX BENEFIT						
	(\$ 26,415)	0.8686			(\$30,411)	
	(\$ 24,618)	0.8095				(\$30,411)

PRESENT VALUE OF NET

OUTFLOW (\$430,741)

PURCHASE PRICE	\$364,926
COST OF CAPITAL	7.30%
MONEY FACTOR	0.03340
CORPORATE TAX RATE	25.00%
THREE-YEAR STRAIGHT LINE DEPRECIATION	\$121,642

6. AT&T THREE-YEAR LEASING FIGURES

FIRST YEAR		SECOND YEAR		THIRD YEAR	
<u>MONTH</u>	<u>VALUE</u>	<u>MONTH</u>	<u>VALUE</u>	<u>MONTH</u>	<u>VALUE</u>
JAN	\$364,926	JAN	\$218,664	JAN	\$ 72,402
FEB	\$352,737	FEB	\$206,475	FEB	\$ 60,213
MAR	\$340,548	MAR	\$194,286	MAR	\$ 35,835
APR	\$328,359	APR	\$182,097	APR	\$ 23,646
MAY	\$316,170	MAY	\$169,908	MAY	\$ 11,457
JUN	\$303,981	JUN	\$157,719	JUN	\$ 0
JUL	\$291,792	JUL	\$145,530	JUL	\$ 0
AUG	\$279,603	AUG	\$133,341	AUG	\$ 0
SEP	\$267,414	SEP	\$121,152	SEP	\$ 0
OCT	\$255,225	OCT	\$108,963	OCT	\$ 0
NOV	\$243,036	NOV	\$ 96,744	NOV	\$ 0
DEC	\$230,847	DEC	\$ 84,585	DEC	\$ 0
TOTAL	\$3,574,638	TOTAL	\$1,819,494	TOTAL	\$251,577
AVERAGE	\$ 297,887	AVERAGE	\$ 151,625	AVERAGE	\$ 20,965

MONTHLY PAYMENTS	\$ 12,189 (MONEY FACTOR X BEG BAL)
ANNUAL PAYMENT	\$146,262 (MONTHLY PAYMENTS X 12)
INTEREST RATE	7.30% (PRESIDENT'S ECONMOMIC REPORT)
BEGINNING BALANCE	\$364,926 (COST OF COMPUTER ACQUISITION)
MONEY FACTOR	0.03340 (PROVIDED BY LEASING COMPANY)
GAIN ON INVESTMENT	
YEAR 1	\$ 20,452 (ANNUAL AVERAGE X INTEREST
YEAR 2	\$ 9,260 RATE FOR EACH YEAR)
YEAR 3	\$ 1,226

F. GOVERNMENT LEASING COMPANY PURCHASE/LEASE COMPARISON

1. PURCHASE FOR TWO YEARS

PRESENT					
	PRESENT	VALUE	END OF YEAR		
<u>CATEGORY</u>	<u>VALUE</u>	<u>FACTOR</u>	<u>YEAR 0</u>	<u>YEAR 1</u>	<u>YEAR 2</u>
PRICE	(\$364,926)	1.0000	(\$364,926)		
COST OF CAP (\$ 18,369)	0.9320		(\$19,709)		
	(\$ 4,234)	0.8686		(\$4,874)	

PRESENT VALUE
OF NET
OUTFLOW (\$387,529)

INITIAL PURCHASE PRICE \$364,926
COST OF CAPITAL 7.30%

2. LEASE FOR TWO YEARS

PRESENT

	PRESENT	VALUE		END OF YEAR	
<u>CATEGORY</u>	<u>VALUE</u>	<u>FACTOR</u>	<u>YEAR 0</u>	<u>YEAR 1</u>	<u>YEAR 2</u>
ANNUAL LEASE (\$193,047)	0.9320			(\$207,132)	
PAYMENTS					
	(\$179,195)	0.8686			(\$207,132)
COST OF	\$ 18,369	0.9320		\$19,709	
CAPITAL					
	\$ 4,155	0.8686			\$4,784
DEPRECIATION (\$ 42,514)	0.9320			(\$45,616)	
TAX BENEFIT					
	(\$ 39,622)	0.8686			(\$45,616)

PRESENT VALUE
OF NET
OUTFLOW (\$431,854)

PURCHASE PRICE	\$364,926
COST OF CAPITAL	7.30%
MONEY FACTOR	0.03340
CORPORATE TAX RATE	25.00%
TWO-YEAR STRAIGHT LINE DEPRECIATION	\$182,463

3. GOVERNMENT LEASING COMPANY TWO YEAR LEASING FIGURES

FIRST YEAR

<u>MONTH</u>	<u>VALUE</u>
JAN	\$364,926
FEB	\$347,665
MAR	\$330,404
APR	\$313,143
MAY	\$295,882
JUN	\$278,621
JUL	\$261,360
AUG	\$244,099
SEP	\$226,838
OCT	\$209,577
NOV	\$192,316
DEC	\$175,055
TOTAL	\$3,239,886
AVERAGE	\$269,991

SECOND YEAR

<u>MONTH</u>	<u>VALUE</u>
JAN	\$157,794
FEB	\$140,533
MAR	\$123,272
APR	\$106,011
MAY	\$ 88,750
JUN	\$ 71,489
JUL	\$ 54,228
AUG	\$ 36,967
SEP	\$ 19,706
OCT	\$ 2,445
NOV	\$ 0
DEC	\$ 0
TOTAL	\$801,195
AVERAGE	\$ 66,766

MONTHLY PAYMENTS \$ 17,261 (MONEY FACTOR X BEG BAL)

ANNUAL PAYMENT \$207,132 (MONTHLY PAYMENTS X 12)

INTEREST RATE 7.30% (PRESIDENT'S ECONMOMIC REPORT)

BEGINNING BALANCE \$364,926 (COST OF COMPUTER ACQUISITION)

MONEY FACTOR 0.04730 (PROVIDED BY LEASING COMPANY)

GAIN ON INVESTMENT

YEAR 1 \$ 19,709 (ANNUAL AVERAGE X INTEREST

YEAR 2 \$ 4,874 RATE FOR EACH YEAR)

4. PURCHASE FOR THREE YEARS

PRESENT

<u>CATEGORY</u>	<u>PRESENT</u>	<u>VALUE</u>	<u>END OF YEAR</u>			
	<u>VALUE</u>	<u>FACTOR</u>	<u>YEAR 0</u>	<u>YEAR 1</u>	<u>YEAR 2</u>	<u>YEAR 3</u>
PRICE	(\$364,926)	1.0000	(\$364,926)			
COST OF CAPITAL	(\$ 20,294)	0.9320		(\$21,775)		
	(\$ 9,695)	0.8686			(\$11,162)	
	(\$ 1,303)	0.8095				(\$1,610)

PRESENT VALUE

OF NET

OUTFLOW (\$396,218)

INITIAL PURCHASE PRICE \$364,926

COST OF CAPITAL 7.30%

5. LEASE FOR THREE YEARS

PRESENT

<u>CATEGORY</u>	<u>PRESENT VALUE</u>		<u>END OF YEAR</u>			
	<u>VALUE</u>	<u>FACTOR</u>	<u>YEAR 0</u>	<u>YEAR 1</u>	<u>YEAR 2</u>	<u>YEAR 3</u>
ANNUAL LEASE PAYMENTS	(\$135,501)	0.9320		(\$145,387)		
	(\$126,283)	0.8686			(\$145,387)	
	(\$117,691)	0.8095				(\$145,387)
COST OF CAPITAL	\$ 20,294	0.9320		\$21,775		
	\$ 9,695	0.8686			\$11,162	
	\$ 1,303	0.8095				\$1,610
DEPRECIATION TAX BENEFIT	(\$ 28,343)	0.9320		(\$30,411)		
	(\$ 26,415)	0.8686			(\$30,411)	
	(\$ 24,618)	0.8095				(\$30,411)

PRESENT VALUE
OF NET
OUTFLOW (\$427,559)

PURCHASE PRICE	\$364,926
COST OF CAPITAL	7.30%
MONEY FACTOR	0.03340
CORPORATE TAX RATE	25.00%
ANNUAL STRAIGHT LINE DEPRECIATION	\$121,642

6. GOVERNMENT LEASING COMPANY THREE YEAR LEASING
FIGURES

FIRST YEAR		SECOND YEAR		THIRD YEAR	
<u>MONTH</u>	<u>VALUE</u>	<u>MONTH</u>	<u>VALUE</u>	<u>MONTH</u>	<u>VALUE</u>
JAN	\$364,926	JAN	\$219,539	JAN	\$ 74,153
FEB	\$352,810	FEB	\$207,424	FEB	\$ 62,036
MAR	\$340,694	MAR	\$195,307	MAR	\$ 49,920
APR	\$328,578	APR	\$183,191	APR	\$ 37,804
MAY	\$316,462	MAY	\$171,075	MAY	\$ 25,688
JUN	\$304,346	JUN	\$158,959	JUN	\$ 13,572
JUL	\$292,230	JUL	\$146,843	JUL	\$ 1,456
AUG	\$280,114	AUG	\$134,727	AUG	\$ 0
SEP	\$267,998	SEP	\$122,611	SEP	\$ 0
OCT	\$255,882	OCT	\$110,495	OCT	\$ 0
NOV	\$243,766	NOV	\$ 98,379	NOV	\$ 0
DEC	\$231,650	DEC	\$ 86,263	DEC	\$ 0
TOTAL	\$3,579,456	TOTAL	\$1,834,812	TOTAL	\$264,628
AVERAGE	\$ 298,288	AVERAGE	\$ 152,901	AVERAGE	\$ 22,052

MONTHLY PAYMENTS	\$ 12,116 (MONEY FACTOR X BEG BAL)
ANNUAL PAYMENT	\$145,387 (MONTHLY PAYMENTS X 12)
INTEREST RATE	7.30% (PRESIDENT'S ECONMOMIC REPORT)
BEGINNING BALANCE	\$364,926 (COST OF COMPUTER ACQUISITION)
MONEY FACTOR	0.03320 (PROVIDED BY LEASING COMPANY)
GAIN ON INVESTMENT	
YEAR 1	\$ 21,775 (ANNUAL AVERAGE X INTEREST
YEAR 2	\$ 11,162 RATE FOR EACH YEAR)
YEAR 3	\$ 1,610

G. DIGITAL EQUIPMENT CORPORATION PURCHASE/LEASE COMPARISON

1. PURCHASE FOR TWO YEARS

<u>CATEGORY</u>	PRESENT		END OF YEAR		
	<u>VALUE</u>	<u>FACTOR</u>	<u>YEAR 0</u>	<u>YEAR 1</u>	<u>YEAR 2</u>
PRICE	(\$364,926)	1.0000	(\$364,926)		
COST OF CAPITAL	(\$ 18,978)	0.9320		(\$20,363)	
	(\$ 5,792)	0.8686			(\$6,668)

PRESENT VALUE
OF NET
OUTFLOW (\$389,696)

INITIAL PURCHASE PRICE \$364,926
COST OF CAPITAL 7.30%

2. LEASE FOR TWO YEARS

PRESENT

<u>CATEGORY</u>	<u>PRESENT VALUE</u>		<u>END OF YEAR</u>		
	<u>VALUE</u>	<u>FACTOR</u>	<u>YEAR 0</u>	<u>YEAR 1</u>	<u>YEAR 2</u>
ANNUAL LEASE PAYMENTS	(\$174,919)	0.9324		(\$187,601)	
	(\$162,950)	0.8686			(\$187,601)
COST OF CAPITAL	\$ 18,978	0.9320		\$20,363	
	\$ 5,792	0.8686			\$6,668
DEPRECIATION TAX BENEFIT	(\$ 42,514)	0.9320		(\$45,616)	
	(\$ 39,622)	0.8686			(\$45,616)

PRESENT VALUE
OF NET
OUTFLOW (\$395,235)

PURCHASE PRICE	\$364,926
COST OF CAPITAL	7.30%
MONEY FACTOR	0.03340
CORPORATE TAX RATE	25.00%
TWO-YEAR STRAIGHT LINE DEPRECIATION	\$182,463

3. DIGITAL EQUIPMENT CORPORATION TWO-YEAR LEASING
FIGURES

FIRST YEAR

<u>MONTH</u>	<u>VALUE</u>
JAN	\$364,926
FEB	\$349,293
MAR	\$333,660
APR	\$318,027
MAY	\$302,394
JUN	\$286,761
JUL	\$271,128
AUG	\$255,495
SEP	\$239,862
OCT	\$224,229
NOV	\$208,596
DEC	\$192,963
TOTAL	\$3,347,334
AVERAGE	\$ 278,945

SECOND YEAR

<u>MONTH</u>	<u>VALUE</u>
JAN	\$177,325
FEB	\$161,692
MAR	\$146,059
APR	\$130,426
MAY	\$114,793
JUN	\$ 99,160
JUL	\$ 83,527
AUG	\$ 67,894
SEP	\$ 52,261
OCT	\$ 36,628
NOV	\$ 20,995
DEC	\$ 5,362
TOTAL	\$1,096,122
AVERAGE	\$ 91,344

MONTHLY PAYMENTS	\$ 15,633 (MONEY FACTOR X BEG BAL)
ANNUAL PAYMENT	\$187,601 (MONTHLY PAYMENTS X 12)
INTEREST RATE	7.30% (PRESIDENT'S ECONOMIC REPORT)
BEGINNING BALANCE	\$364,926 (COST OF COMPUTER ACQUISITION)
MONEY FACTOR	0.04284 (PROVIDED BY LEASING COMPANY)
GAIN ON INVESTMENT	
YEAR 1	\$ 20,363 (ANNUAL AVERAGE X INTEREST
YEAR 2	\$ 6,668 RATE FOR EACH YEAR)

4. PURCHASE FOR THREE YEARS

PRESENT

<u>CATEGORY</u>	<u>PRESENT</u>	<u>VALUE</u>	<u>END OF YEAR</u>			
	<u>VALUE</u>	<u>FACTOR</u>	<u>YEAR 0</u>	<u>YEAR 1</u>	<u>YEAR 2</u>	<u>YEAR 3</u>
PRICE	(\$364,926)	1.0000	(\$364,926)			
COST OF CAPITAL	(\$ 20,561)	0.9320		(\$22,061)		
	(\$ 10,845)	0.8686			(\$12,071)	
	(\$ 2,022)	0.8095				(\$2,498)

PRESENT VALUE
OF NET
OUTFLOW (\$398,354)

INITIAL PURCHASE PRICE \$364,926
COST OF CAPITAL 7.30%

5. LEASE FOR THREE YEARS

PRESENT

<u>CATEGORY</u>	PRESENT VALUE		END OF YEAR			
	<u>VALUE</u>	<u>FACTOR</u>	<u>YEAR 0</u>	<u>YEAR 1</u>	<u>YEAR 2</u>	<u>YEAR 3</u>
ANNUAL LEASE (\$127,542)	0.9320			(\$136,848)		
PAYMENTS						
	(\$118,866)	0.8686			(\$136,848)	
	(\$110,779)	0.8095				(\$136,848)
COST OF CAPITAL	\$ 20,561	0.9320		\$22,061		
	\$ 10,845	0.8686			\$12,071	
	\$ 2,022	0.8095				\$2,498
DEPRECIATION (\$ 28,343)	0.9320			(\$30,411)		
TAX BENEFIT						
	(\$ 26,415)	0.8686			(\$30,411)	
	(\$ 24,618)	0.8095				(\$30,411)
PRESENT VALUE OF NET OUTFLOW	(\$403,135)					
PURCHASE PRICE				\$364,926		
COST OF CAPITAL				7.30%		
MONEY FACTOR				0.03340		
CORPORATE TAX RATE				25.00%		
ANNUAL STRAIGHT LINE DEPRECIATION				\$121,642		

6. DIGITAL EQUIPMENT CORPORATION THREE YEAR LEASING
FIGURES

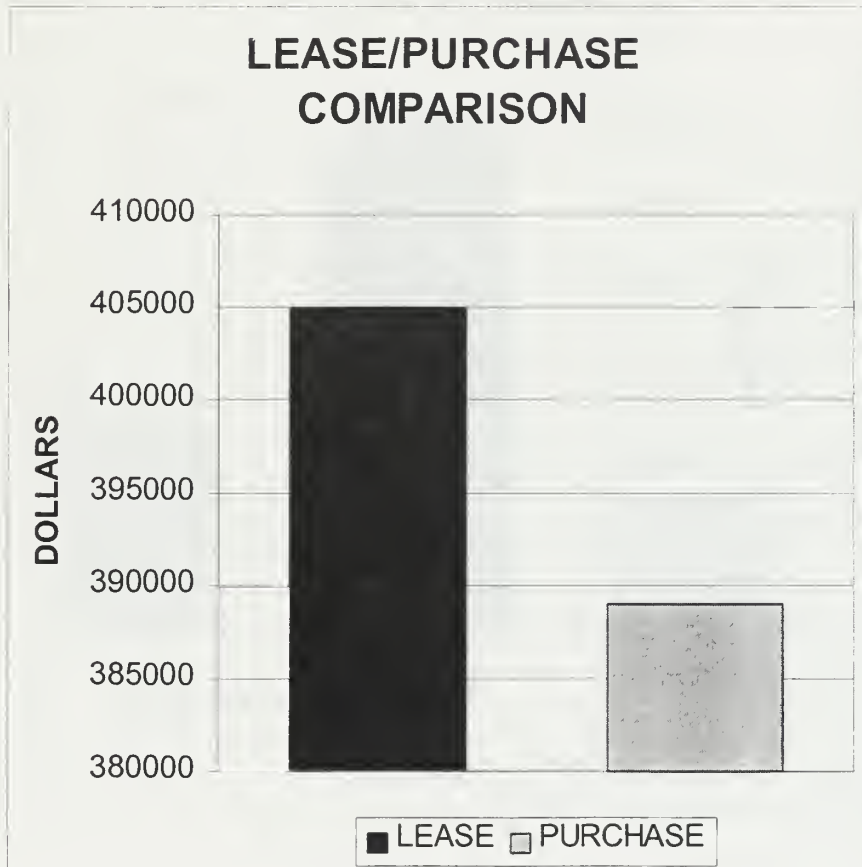
FIRST YEAR		SECOND YEAR		THIRD YEAR	
<u>MONTH</u>	<u>VALUE</u>	<u>MONTH</u>	<u>VALUE</u>	<u>MONTH</u>	<u>VALUE</u>
JAN	\$364,926	JAN	\$228,079	JAN	\$ 91,232
FEB	\$353,522	FEB	\$216,675	FEB	\$ 79,828
MAR	\$342,118	MAR	\$205,271	MAR	\$ 68,424
APR	\$330,714	APR	\$193,867	APR	\$ 57,020
MAY	\$319,310	MAY	\$182,463	MAY	\$ 45,616
JUN	\$307,906	JUN	\$171,059	JUN	\$ 34,212
JUL	\$296,502	JUL	\$159,655	JUL	\$ 22,808
AUG	\$285,098	AUG	\$148,251	AUG	\$ 11,404
SEP	\$273,694	SEP	\$136,847	SEP	\$ 0
OCT	\$262,290	OCT	\$125,443	OCT	\$ 0
NOV	\$250,886	NOV	\$114,039	NOV	\$ 0
DEC	\$239,482	DEC	\$102,635	DEC	\$ 0
TOTAL		TOTAL	\$1,984,284	TOTAL	\$410,544
AVERAGE		AVERAGE	\$165,357	AVERAGE	\$ 34,212

MONTHLY PAYMENTS	\$ 11,404 (MONEY FACTOR X BEG BAL)
ANNUAL PAYMENT	\$136,847 (MONTHLY PAYMENTS X 12)
INTEREST RATE	7.30% (PRESIDENT'S ECONMOMIC REPORT)
BEGINNING BALANCE	\$364,926 (COST OF COMPUTER ACQUISITION)
MONEY FACTOR	0.03125 (PROVIDED BY LEASING COMPANY)
GAIN ON INVESTMENT	
YEAR 1	\$ 22,061 (ANNUAL AVERAGE X INTEREST
YEAR 2	\$ 12,071 RATE FOR EACH YEAR)
YEAR 3	\$ 2,498

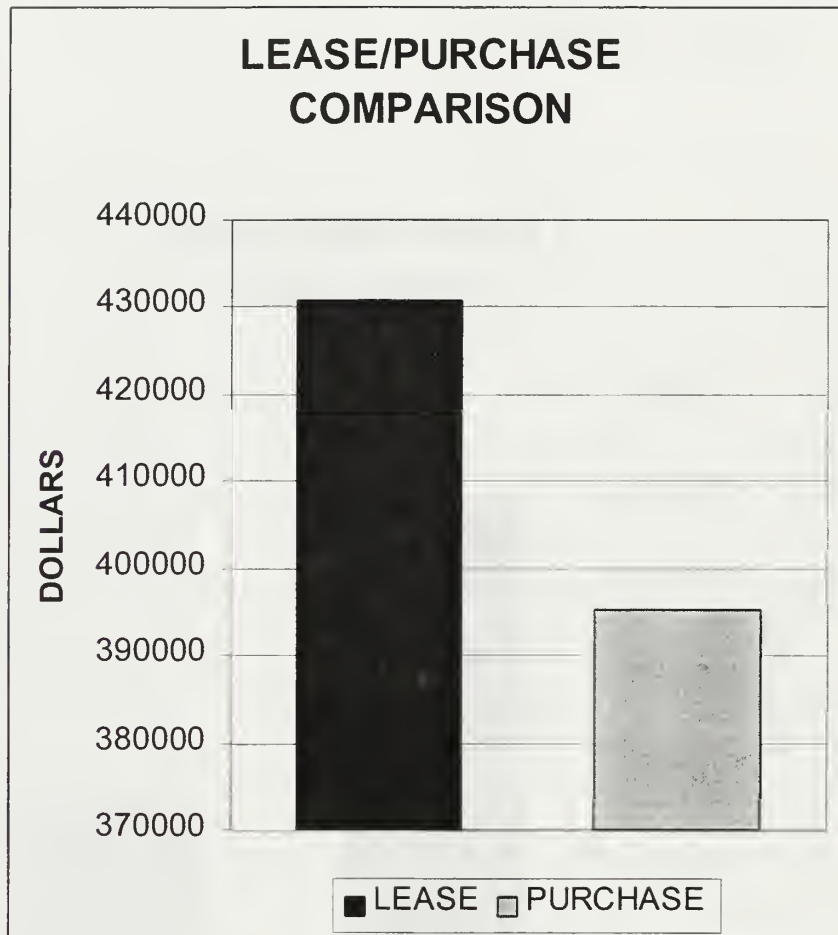
VI. PRESENTATION OF DATA

A. AT&T COMPARISON GRAPHS

1. TWO-YEAR PERIOD

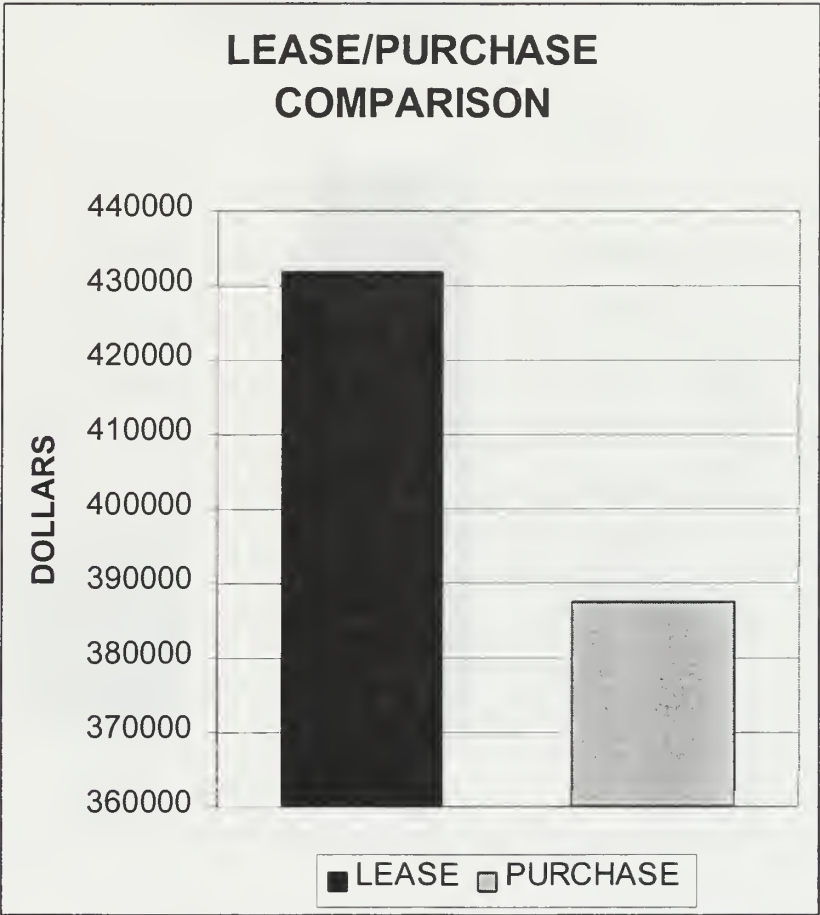


2. THREE-YEAR PERIOD

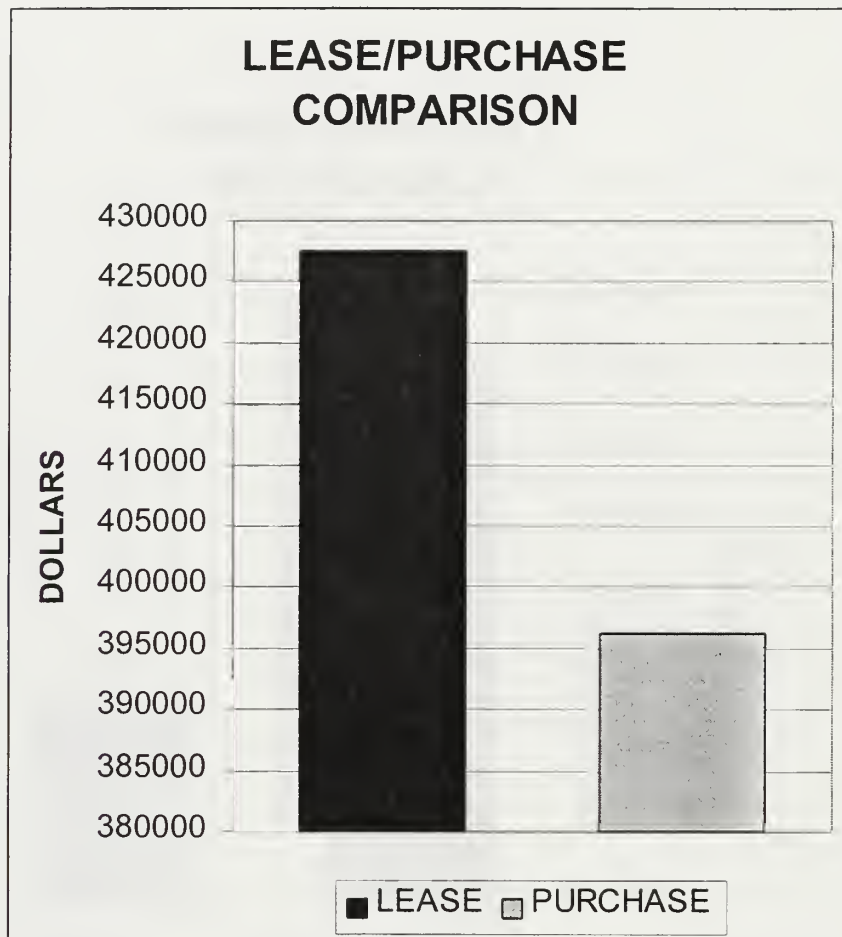


B. GOVERNMENT LEASING COMPANY COMPARISON GRAPHS

1. TWO-YEAR PERIOD

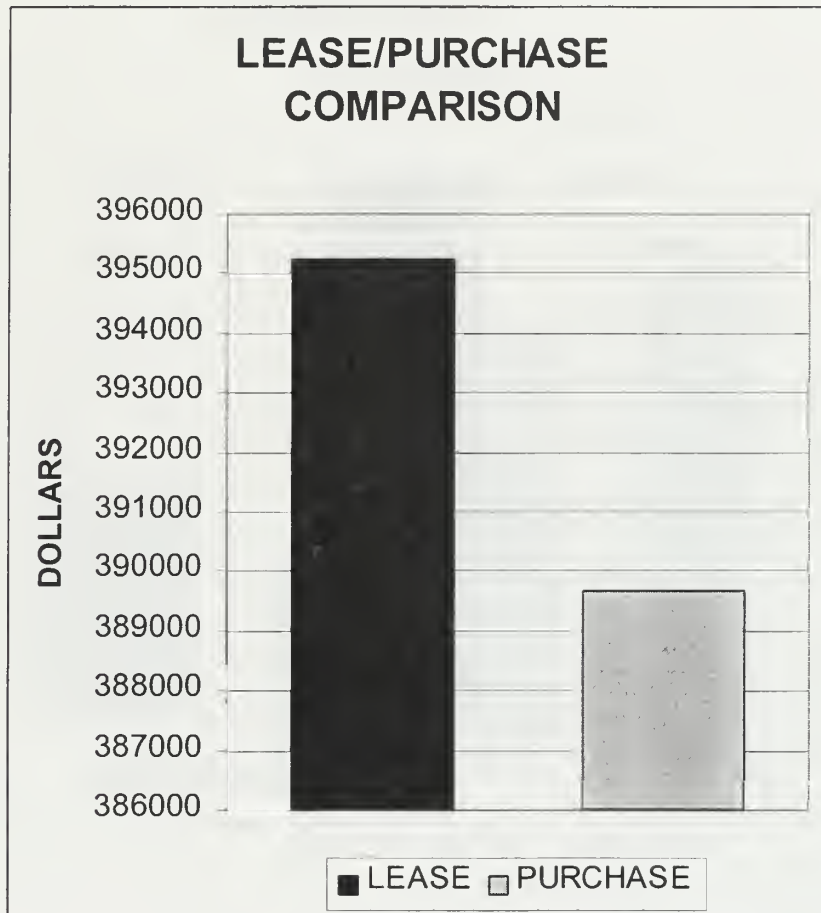


2. THREE-YEAR PERIOD

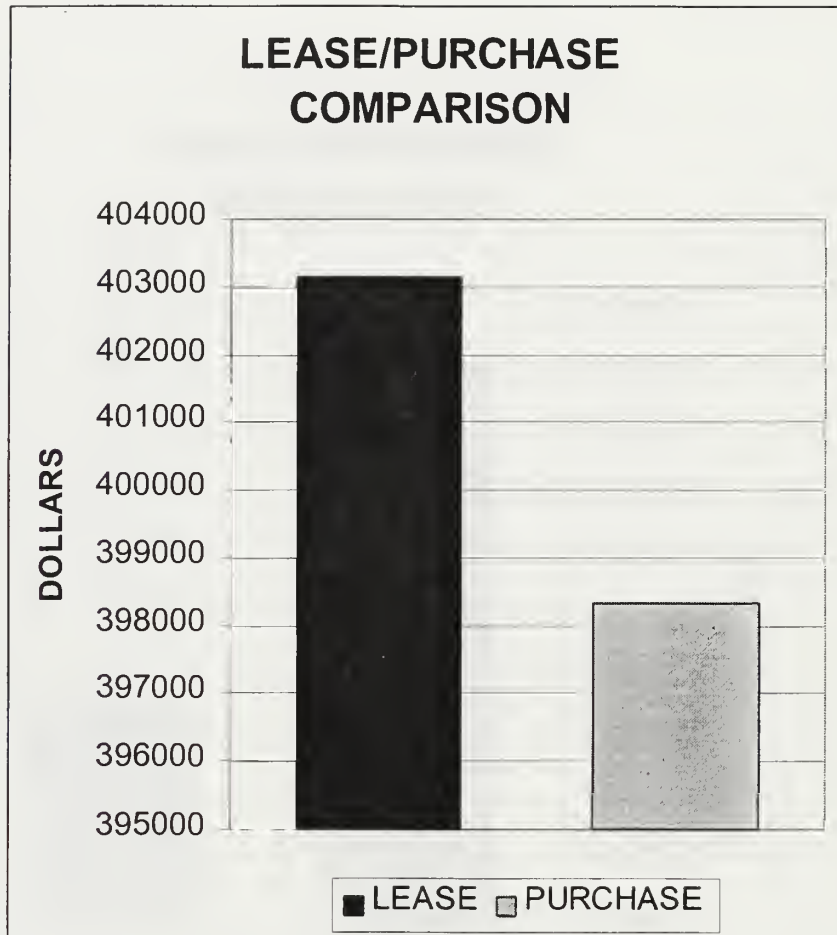


C. DIGITAL EQUIPMENT CORPORATION COMPARISON GRAPHS

1. TWO-YEAR PERIOD

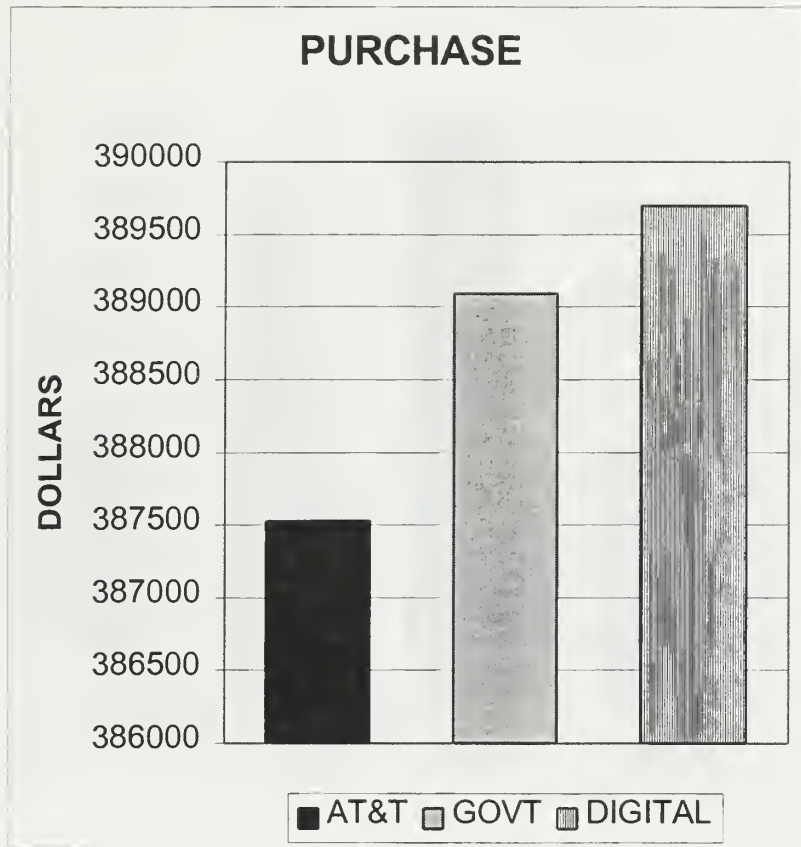


2. THREE-YEAR PERIOD

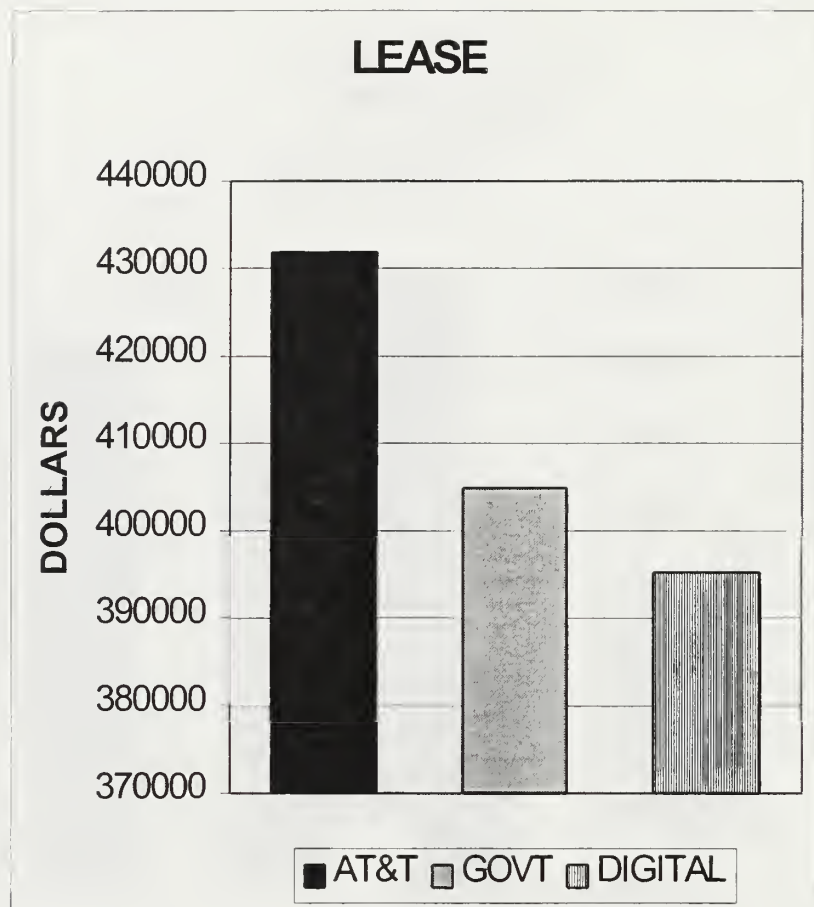


D. CONSOLIDATED GRAPH FOR ALL THREE COMPANIES

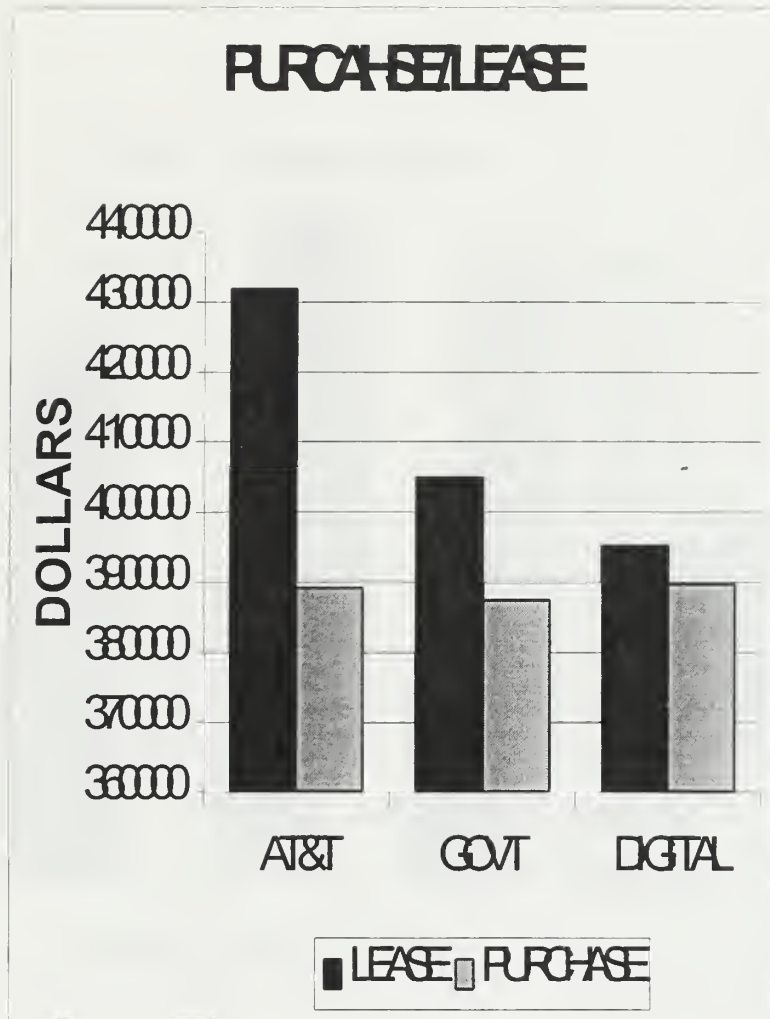
1. TWO-YEAR PERIOD PURCHASE COMPARISON



2. LEASE COMPARISON

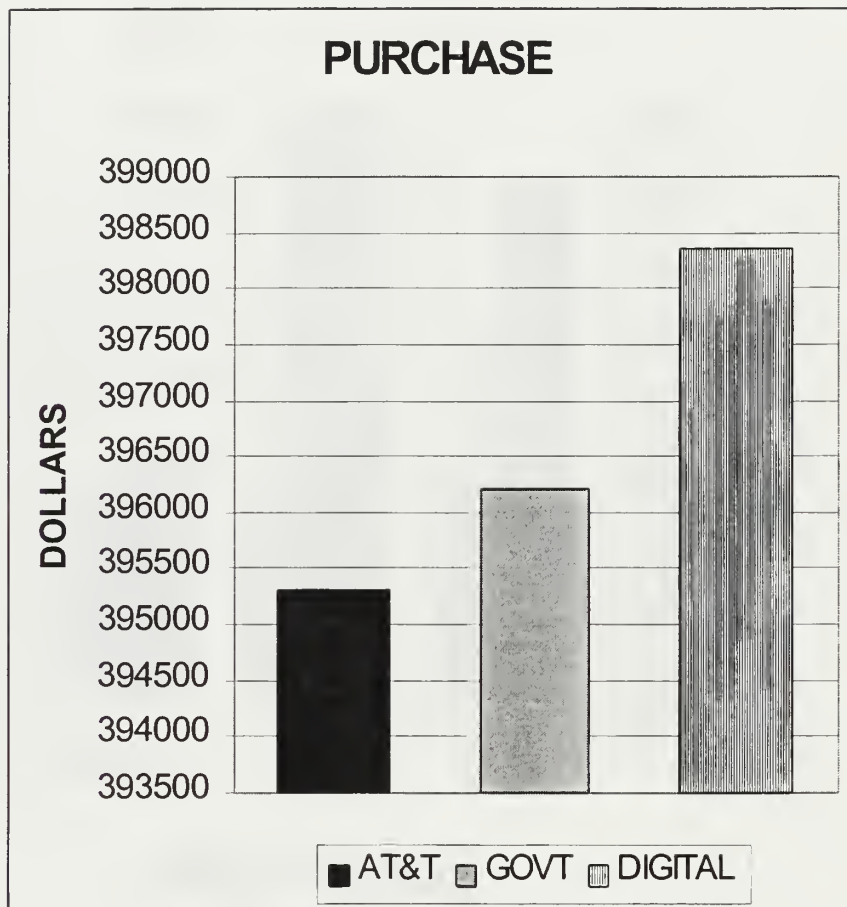


3. PURCHASE AND LEASE COMPARISON

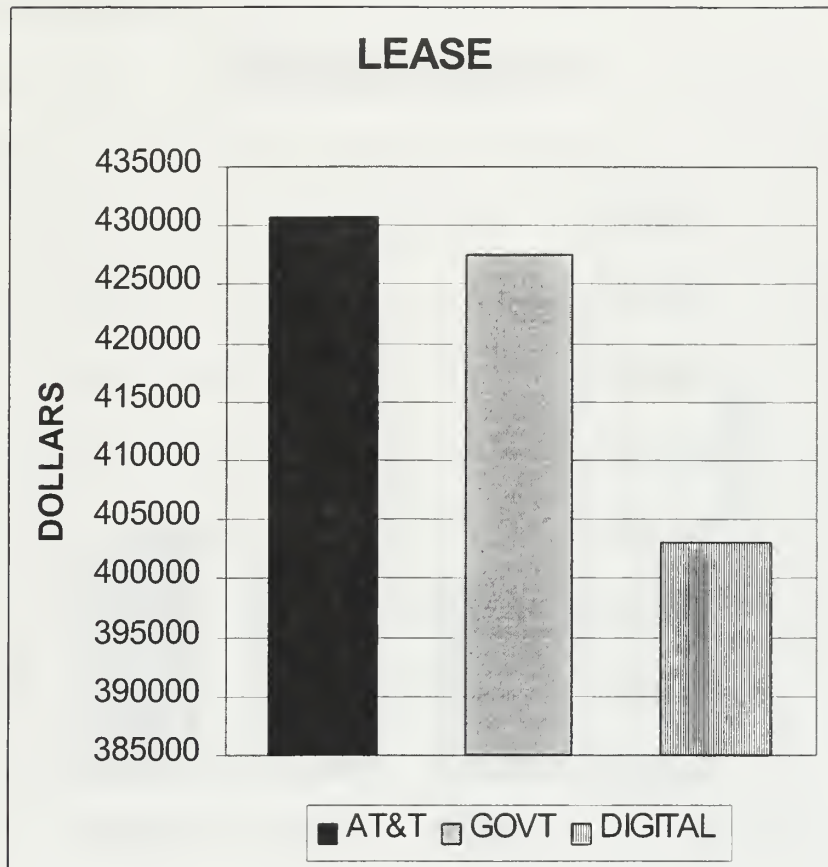


E. CONSOLIDATED GRAPH FOR THREE-YEAR PERIOD

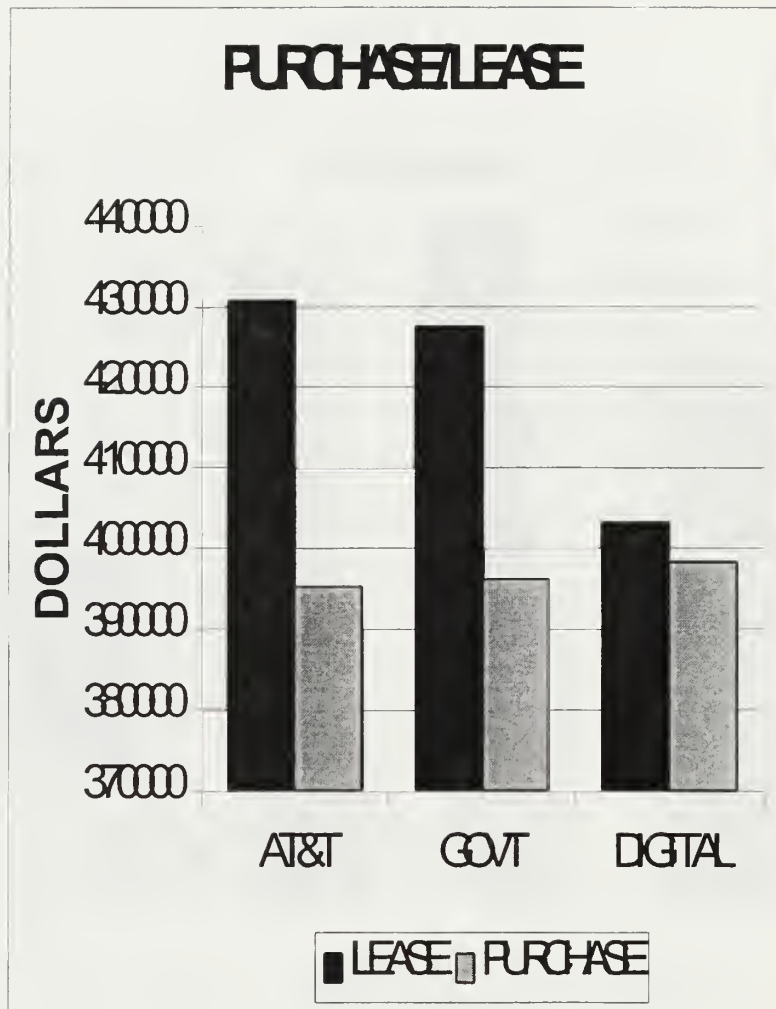
1. PURCHASE COMPARISON



2. LEASE COMPARISON



3. PURCHASE AND LEASE COMPARISON



VII. CONCLUSION

A. CONCLUSIONS

Technology is rapidly changing over shorter and shorter time-frames. As these rapid advancements are made, it renders current technology obsolete. Therefore, government agencies, public corporations and private firms are constantly faced with the dilemma of maintaining current equipment while cutting costs. This thesis evaluated a leasing alternative as a means to achieve this goal. However, I do not feel that leasing will provide any substantial benefits over purchasing.

A computer's useful life is anywhere from two to three years in most cases, and then it is technologically obsolete. This is the case, even though the equipment itself is still in good working order. Once it reaches its useful life, it has little or no economic value. Therefore, leasing companies will structure leases to reflect this fact over time. It would not be of sound business practices for a leasing company to absorb the cost of an asset that no longer had any value. This is the ,

reason that the residual values (one to three percent) are so low at the end of the leasing period - the asset has no longer has a useful life.

B. RECOMMENDATIONS

It is my recommendation that the Federal Government not enter into leasing arrangements on computer equipment. It would be more beneficial for the government to purchase the gear outright. If computers realize an extended life and technology developments are prolonged, then a leasing arrangement might be feasible. However, at the current time this is not a valid option and should not be pursued.

C. FOLLOW-ON RESEARCH

This thesis evaluated a cost versus lease scenario for the acquisition of computers at the Naval Postgraduate School. Another area that should be researched is the possibility of having a civilian firm administer the entire informational processing requirements the school.

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